I claim:

1. A two step method for solid state polymerization of dry crystalline thermoplastic polymers to form polymers exhibiting superior mechanical properties and high intrinsic viscosities, the method comprising:
(a) mechanically fluidizing dry crystalline thermoplastic polymer particles in the absence of oxygen by means of blades moving through fluidized polymer particles at velocities sufficient to provide surface contact and friction between the particles sufficient to heat the particles to an incipient melt temperature of the particles and to maintain the temperature until solid state polymerization occurs to provide a desired high intrinsic viscosity; and,
(b) immediately quenching the polymer particles by application of liquefied cryogenic gases directly to surfaces of the polymer particles in amounts sufficient to cool the particles to a temperature lower than a glass transition temperature before crystals in the polymer particles aggregate into large spherulites.

2. The method of Claim 1 wherein the crystalline polymers comprise between 10 and 75 percent crystals.

3. The method of Claim 1 wherein the crystalline thermoplastic polymers are selected from the group consisting of polyesters, polyamides, polyurethanes, polyolefins, polycarbonates, polyphenylene sulfides, and copolymers thereof.

4. The method of Claim 1 wherein the mechanical fluidizing is performed in a horizontal cylindrical solid state polymerization reactor in which the crystalline polymer

particles are mechanically fluidized by a plurality of fluidizing blades moving around, and in close proximity to the inner wall of the horizontal cylinder at speeds which cause friction between the particles and the fluidizing blades and between the particles, the friction providing heat and mechanical stress on the polymer particles by deforming them.

5. The method of Claim 1, wherein the fluidizing blades are operated at velocities sufficient to provide surface rubbing between the particles and friction therefrom to heat the particles to incipient melt temperatures of the polymers between 110 and 350°C.

6. The method of Claim 1 wherein the incipient melt temperatures are maintained for a period of time amounting to between 10 minutes and 2 hours until the solid state polymerization occurs to provide the desired high intrinsic viscosity in the polymer.

7. The method of Claim 1 wherein immediate quenching is performed in a quenching vessel comprising a horizontal cylinder rotating around its longitudinal axis with liquefied cryogenic gases applied directly onto the polymer particles rolling in the horizontal cylinder.

8. The method of Claim 1 wherein the immediate quenching of the polymer particles by application of liquefied cryogenic gases directly to the surfaces of the polymer particle cools the solid state polymerized particles to a temperature lower than the glass transition temperature of the polymer in 5 minutes or less, thereby preventing the aggregation of crystals to form large spherulites.

9. The method of Claim 1 wherein the liquefied cryogenic gases are selected from the group consisting of nitrogen, carbon dioxide, and air.

10. The method of Claim 1 wherein the cryogenic gases, except liquefied air, evaporated in the quenching on the polymer particles are recovered and used to displace the air during the mechanical fluidization of the crystalline thermoplastic polymer.

11. The method of Claim 1 wherein the crystalline thermoplastic polymers are prepared by heating atactic thermoplastic polymers at temperatures exceeding the glass transition temperature until the polymers contain less than 0.05 percent water and between 10 and 75 percent crystals.

12. The method of Claim 1 wherein the two steps of the method are operated in a continuous manner with the crystalline thermoplastic polymer continuously charged to the solid state polymerization reactor and sent continuously therefrom for quenching by direct application of liquefied cryogenic gases in a quenching vessel comprising a horizontal cylinder rotating around its center axis and rolling the polymer particles along the inner wall of the cylinder.

13. A continuous two-step method of solid state polymerization of dry crystalline polyester or polyamide polymers to form polymers exhibiting superior tensile strength, and high intrinsic viscosities, the method comprising:

(a) continuously charging in the absence of air dry crystalline polyester or polyamide polymer particles comprising between 35 and 60 percent crystals to a horizontal cylindrical solid state polymerization reactor in which the crystalline polyester or polyamide polymer particles are mechanically fluidized by a plurality of fluidizing blades moving around an in close proximity to the inner wall of the horizontal cylinder at speeds which cause friction between the particles providing heat and mechanical stress on the polyester or polyamide particles by deforming them, the heat being sufficient to heat the particles to incipient melt temperatures of the particles between 135 and 300°C, and to maintain the temperature for between 30 and 90 minutes until solid state polymerization occurs to provide the desired high intrinsic viscosities between 0.7 and 1.0 dl/g; and,
(b) continuously discharging the solid state polymerized polyester or polyamide polymer particles from the polymerization reactor directly into a quenching vessel comprising a horizontal cylinder rotating around its center axis with liquefied nitrogen applied directly onto the polymer particles rolling in the horizontal cylinder to immediately cool the particles to a temperature lower than the glass transition temperature of the polyester or polyamide polymers, and continuously discharging the cool polyester or polyamide particles.

14. The method of Claim 13 wherein a polymerization catalyst is included in the crystalline polyester or polyamide polymers to increase the rate of solid state polymerization.